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09/610,094	06/30/2000	Glenn David Crabtree	13DV13689	3123

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EXAMINER	
STEVENS, THOMAS H	
ART UNIT	**PAPER NUMBER**
2123	

DATE MAILED: 09/23/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/610,094	CRABTREE ET AL.	
	Examiner	Art Unit	
	Thomas H. Stevens	2123	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 July 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 June 2000* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-20 were examined.

Response to Applicants Arguments

35 U.S.C. 102/103

2. Applicants are thanked for responding to this issue. Rejections ~~is~~ are withdrawn; however, upon further consideration, new grounds for rejection is made in view of prior sited by the examiner (see rejection section).

35 U.S.C. 112

3. Applicants are thanked for responding to this issue. The examiner acknowledges and accepts applicant's definition of "reference pipe", thus rejection is withdrawn.

Drawings

4. Applicants are thanked for responding to this issue. By applicants admission, stating "figures show concepts associated with applicant's invention...to facilitate understanding of the invention" (pg. 16, line 11-13) are ***associated*** and ***not created*** by applicant. Therefore, recommendation stands.

Rejections

Claim Interpretation

5. Office personnel are to give claims their **"broadest reasonable interpretation"** in light of the supporting disclosure. *In re Morris,* 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Limitations appearing in the specification but not recited in the claim are not read into the claim. *In re Prater,* 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-551(CCPA 1969). See *also *In re Zletz,* 893 F.2d 319, 321-22, 13 USPQ2d 1320, 1322(Fed. Cir. 1989) ("During patent examination the pending claims must be interpreted as broadly as their terms reasonably allow") .... The reason is simply that during patent prosecution when claims can be amended, ambiguities should be recognized, scope and breadth of language explored, and clarification imposed .... An essential purpose of patent examination is to fashion claims that are precise, clear, correct, and unambiguous. Only in this way can uncertainties of claim scope be removed, as much as possible, during the administrative process. **The examiner defines the aircraft turbo fan inside the inlet of the aircraft engine as axi-periodic, while the infinite reference pipe nor "super element" was not consider; reference pipe of any dimension/length limitation was considered. Subsequently, the examiner equivocates permittivity (as a measure of the ability of a material to resist the formation of an electric field within it) and resistance. Furthermore, the examiner assumes mathematical computations (i.e., algorithms) are, inherently, computer executed.**

Claim Rejections - 35 USC § 103

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1-20 are rejected under 35 U.S.C. 103 (a) as unpatentable by D' Angelo et al., ("A New Finite Element Formation for RF Scattering by Complex Bodies of Revolution" (1993)), in view of Barka et al., ("An Efficient Algorithm for the RCS Modulation Prediction from Jet Inlet Engines" (1999)).

D' Angelo et al. teaches solving electromagnetic scattering from complex inhomogeneous axi-symmetric bodies using finite element analysis; but is not tailored to specific axi-symmetric aircraft related devices.

Barka et al. teaches using electromagnetic scattering from the interior of a complex jet engine inlet to contribute to the overall radar cross section (RCS) of a modern jet aircraft.

At the time the invention, it would have been obvious to one of ordinary skill in the art to use Barka et al. to modify D' Angelo et al. since it would be advantageous to capture the RCS from another dimension is space for an precise 3-D representation.

Claim 1. A method of calculating a radar cross section of an aircraft component having an axi-periodic structure comprising the steps of (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract): creating a finite element model for the aircraft component describing electromagnetic characteristics of the aircraft component (Barka: pg. 2566, Introduction); transforming the finite element model into a plurality of independent modes (Barka: pg. 2567, lines 11-12); determining, for each independent mode of the plurality of independent mode (Barka: pg. 2566, lines 19-22); a portion of an electromagnetic field contributed by each independent mode(Barka:pg. 2567, lines 11-12); summing the portion of the electromagnetic field contributed by each independent mode of the plurality of independent modes to calculate a total electromagnetic field for the aircraft component (D'Angelo: pg. 538, equation 21); and determining the radar cross section for the aircraft component from the total electromagnetic field (Barka: Introduction; D'Angelo:section III, Radar Cross Section Calculation, pg.537-539).

Claim 2. The method of claim 1 (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein said step of creating a finite element model for the aircraft component further comprises the step of creating a finite element model of a preselected period of the axi-periodic structure of the aircraft component (Barka: Introduction and D'Angelo: pg. 536, figure 1a and 2a and 539-540, right column, lines 5-15 and left column, lines 1-8, respectively).

Claim 3. The method of claim 2 (Barka: Introduction; and D'Angelo: pg. 536, figure 1a and 2a and 539-540, right column, lines 5-15 and left column, lines 1-8, respectively) and wherein said step of transforming the finite element model into a plurality of independent modes further comprises the additional steps of: assembling a system matrix for the finite element model of the preselected period of the axi-periodic structure of the aircraft component; and applying a Discrete Fourier Transform to the system matrix (D'Angelo: pg.537, equation 20).

Claim 4. The method of claim 1(Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein said step of creating a finite element model for the aircraft component further comprises the step of creating the finite element model using second order edge elements (D'Angelo: pg. 535, equation 13).

Claim 5. The method of claim 4(Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein the second order edge elements (D'Angelo: pg. 536, left column, lines 6-8) are curl conforming type elements(D'Angelo: pg. 535, equation 13).

Claim 6. The method of claim 1(Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein said step of determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic field contributed by each independent mode further comprises the additional steps of creating a mathematical representation of a reference pipe having an infinite length (D'Angelo: pg.540, lines 8-31); and using the mathematical representation of the reference pipe to determine the portion of the electromagnetic field contributed by each independent mode (D'Angelo: pg. 539-540, Results and Discussion).

Claim 7. The method of claim 6 (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein said step of determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic field contributed by each independent mode further comprises the additional steps of creating a mathematical representation (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) of a test fixture; creating a mathematical representation of the aircraft component in a cavity (Barka: pg. 2566, lines 17-19); coupling the mathematical representation of the test fixture to the mathematical representation of the aircraft component to create a mathematical representation of a combination of the test fixture and the aircraft

component (Barka: pg. 2568, figure 1 with pg.2566, lines 1-8 and 23); coupling the mathematical representation of the reference pipe(Barka: pg. 2567, lines 1-3) to the mathematical representation of the combination of the test fixture and the aircraft component to create a mathematical representation of the reference pipe (Barka: pg. 2567, lines 1-3), the test fixture and the aircraft component having a common interface between the test fixture and the reference pipe (Barka: pg. 2567, lines 1-3); and solving the mathematical representation of the reference pipe, the test fixture and the aircraft component by introducing a mathematical representation of an incident wave at the common interface of the test fixture and the reference pipe (Barka: pg. 2568, figure 1 with pg.2566, lines 1-8 and 23).

Claim 8. The method of claim 7 (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein said step of creating a mathematical representation of a test fixture further comprises the additional steps of creating a single layer of finite elements describing electromagnetic characteristics of the test fixture (Barka: pg. 2566, lines 18-22); assembling a system matrix for the single layer of finite elements (Barka: pg. 2566, lines 18-24); factoring the system matrix for the single layer of finite elements into a test fixture impedance matrix, wherein the test fixture impedance matrix represents end surfaces of the test fixture having a length; and doubling the length of the test fixture represented by the test fixture impedance matrix until a preselected length of test fixture is represented by the test fixture impedance matrix (Barka: pg. 2566, lines 18-24).

Claim 9. The method of claim 8 (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein said step of creating a mathematical representation of a reference pipe having an infinite length further comprises the additional steps of (Barka: pg. 2567, lines 1-3 and D'Angelo: pg. 540, lines 14-31): copying the test fixture impedance matrix representing the test fixture of the preselected length to create a reference pipe impedance matrix, wherein the reference pipe impedance matrix represents end surfaces of the reference pipe having the preselected length; and doubling the length of the reference pipe represented by the reference pipe impedance matrix until a length of reference pipe is represented wherein the end surfaces of the reference pipe are uncoupled (Barka: pg. 2567, lines 1-3 and D'Angelo: pg. 540, lines 14-31).

Claim 10. The method of claim 7(Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein the mathematical representation of the test fixture, the mathematical representation of the reference a pipe and the mathematical representation of the aircraft component, are each a super-element and the method further comprises the steps of storing the super-elements for the test fixture (Barka: pg. 2567, lines 1-3 and D'Angelo: pg. 540, lines 14-31), reference pipe and aircraft component in memory; modifying the aircraft component (Barka: pg. 2567, lines 1-13); and reusing stored super-elements for the test fixture and reference pipe to calculate a radar cross section for the modified aircraft component (Barka: pg. 2567, lines 5-11).

Claim 11. The method of claim 7(Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein said step of determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic field contributed by each independent mode further comprises the additional steps of coupling the mathematical representation of the reference pipe to another identical mathematical representation of the reference pipe to create a mathematical representation of a two-sided reference pipe having a common interface (Barka: pg. 2567, lines 1-3 and D'Angelo: pg. 540, lines 14-31); solving the mathematical representation of the two-sided reference pipe by introducing the incident wave at the common interface of the two reference pipes (D'Angelo: pg. 540, lines 14-31); and determining the difference between the solution of the representation of the reference pipe, test fixture and aircraft component and the solution of the representation of the two-sided reference pipe (Barka: pg. 2567, lines 11-13).

Claim 12. The method of claim 1 (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein the plurality of independent modes comprises primary modes and conjugate modes related to the primary modes and said step of determining, for each independent mode of the plurality of independent modes, the portion of an electromagnetic field contributed by each independent mode further comprises the additional steps of determining an impedance matrix (Barka: pg. 2567, lines 26-34) for each primary mode of the plurality independent modes; and determining an impedance matrix (D'Angelo: pg. 539, right column lines 5-15 with pg. 540, lines 1-8) for each

conjugate mode by transposing the impedance matrix of the corresponding primary mode for each conjugate mode.

Claim 13. A computer program (Barka: pg. 2567, lines 5-12) product embodied on a computer readable medium and executable by a computer for calculating the radar cross section (RCS) of an aircraft engine face component, the computer program product comprising computer instructions for executing the steps of creating a finite element model for the aircraft engine face component describing electromagnetic characteristics of the aircraft engine face component (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract); transforming the finite element model into a plurality of independent modes(Barka: pg. 2567, lines 5-12); determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic field contributed by each independent mode (Barka: pg. 2567, lines 18-34); summing the portion of the electromagnetic field contributed by each independent mode of the plurality of independent modes to calculate a total electromagnetic far-field for the aircraft engine face component (D'Angelo: pg. 537, equation 17); and determining the radar cross-section for the aircraft engine face component from the total electromagnetic far-field (D'Angelo: pg.537, equation 18).

Claim 14. The computer program product of claim 13 (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein the step of determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic field

contributed by each independent mode further comprises the additional steps of creating a mathematical representation of a test fixture (Barka: pg. 2566, lines 18-22); creating a mathematical representation of the aircraft engine face component in a cavity (Barka: pg. 2566, Introduction); creating a mathematical representation of a reference pipe having an infinite length; coupling the(Barka: pg. 2567, lines 1-3 and D'Angelo: pg. 540, lines 14-31); mathematical representation of the test fixture to the mathematical representation of the aircraft engine face component to create a mathematical representation of the combination of the test fixture and the aircraft engine face component (D'Angelo: pg. 535, equation 13 and pg. 536, left column, lines 1-4; with Barka: pg. 2566, Introduction); coupling the mathematical representation of the reference pipe to the mathematical representation of the combination of the test fixture and the aircraft engine face component to create a mathematical representation of the reference pipe, the test fixture and the aircraft component having a common interface between the test fixture and the reference pipe (D'Angelo: pg. 535, equation 13 and pg. 536, left column, lines 1-4; with Barka: pg. 2566, Introduction, and pg. 2567, lines 1-3); and solving the mathematical representation of the reference pipe, the test fixture and the aircraft engine face component by introducing a mathematical representation of an incident wave at the common interface of the test fixture and the reference pipe (D'Angelo: pg. 540, conclusions with pg. 539 figures 7 and 8; with Barka: pg. 2567, lines 18-34).

Claim 15. The computer program product of claim 14 (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein the step of determining, each independent mode of the plurality of independent modes, a portion of an electromagnetic field contributed by each independent mode further comprises the additional steps of (D'Angelo: pg. 537, equation 20): coupling the mathematical representation of the reference pipe to another identical mathematical representation of the reference pipe to create a mathematical representation of a two-sided reference pipe having a common interface (D'Angelo: pg. 535, equation 13 with pg. 536, left column, lines 1-4; and Barka: pg. 2567, lines 1-3); solving the mathematical representation of the two-sided reference pipe by introducing the incident wave at the common interface of the two reference pipes (D'Angelo: pg. 540, conclusions with pg. 539, figures 7 and 8; with Barka: pg. 2567, lines 18-34); and determining the difference between the solution of the representation of the reference pipe, test fixture and aircraft engine face component and the solution of the representation of the two-sided reference pipe (D'Angelo: pg. 540, conclusions with pg. 539, figures 7 and 8; with Barka: pg. 2567, lines 18-34).

Claim 16. The computer program product of claim 13 (Barka: pg. 2567, lines 5-12 and 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein the aircraft engine face component has an axi-periodic structure and said step of creating a finite element model for the aircraft engine face component comprises the additional step of creating a finite element model of a preselected period of the axi-periodic structure of theaircraft engine face component using second order edge elements (D'Angelo: pg. 536,lines 6-9).

Claim 17. A system for calculating the radar cross section (RCS) of an aircraft engine component comprising (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract): a computer having memory and a processing unit; means for creating a finite element model for the aircraft engine component describing electromagnetic characteristics of the aircraft engine component (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract); means for transforming the finite element model into a plurality of independent modes (Barka: pg. 2566, lines 11-18); means for determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic near-field contributed by each independent mode (Barka: pg. 2566, lines 11-18 and pg. 2567, lines 21-22); and means for summing the portion of the electromagnetic near-field contributed by each independent mode of the plurality of independent modes to calculate a total electromagnetic near-field for the aircraft engine component(Barka: pg. 2566, lines 11-18); means for determining a total electromagnetic far-field for the aircraft engine component from the total electromagnetic near-field for the aircraft engine component(Barka: pg. 2566, lines 11-18); and means for determining the radar cross section for the aircraft engine component from the total electromagnetic far-field (Barka: pg. 2567, lines 18-34).

Claim 18. The system of claim 17 wherein: the aircraft engine component has an axi-periodic structure (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract); said means for creating a finite element model for the aircraft engine component (Barka:

pg. 2566, lines 1-3 and 11): further comprises: means for creating a finite element model of a preselected period of the axi-periodic structure of the aircraft engine component; and said means for transforming the finite element model into a plurality of independent modes further comprises: means for assembling a system matrix for the finite element model of the preselected period of the axi-periodic structure of the aircraft engine (Barka: pg. 2566, Introduction; and D'Angelo: abstract) component; and means for applying a Discrete Fourier Transform to the system matrix (D'Angelo: pg.537, equation 20).

Claim 19. The system of claim 1, (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein said means for determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic near-field (D'Angelo: equation 13 with section III Radar Cross Section Calculation) contributed by each independent mode comprises: means for creating an impedance matrix for a test fixture (Barka: pg. 2567, lines 1-3 and D'Angelo: pg. 540, lines 14-31); means for creating an impedance matrix for the aircraft engine component in a cavity (Barka: pg. 2567, lines 1-3 and D'Angelo: pg. 540, lines 14-31); means for creating an impedance matrix for a reference pipe having an infinite length (Barka: pg. 2567, lines 1-3 and D'Angelo: pg. 540, lines 14-31); means for coupling the impedance matrix for the test fixture to the impedance matrix for the aircraft engine component to create an impedance matrix for the combination of the test fixture and the aircraft engine component (Barka: pg. 2567,

lines 1-3 and D'Angelo: pg. 540, lines 14-31); means for coupling the impedance matrix for the reference pipe to the impedance matrix for the combination of the test fixture and the aircraft component to create an impedance matrix for the reference pipe, the test fixture and the aircraft engine component having a common interface between the test fixture and the reference pipe(Barka: pg. 2567, lines 1-3 and D'Angelo: pg. 540, lines 14-31); and means for solving the impedance matrix for the reference pipe, the test fixture and the aircraft engine component by introducing a mathematical representation of an incident wave at the common interface of the test fixture and the reference pipe (Barka: pg. 2567, lines 1-3 and D'Angelo: pg. 540, lines 14-31).

Claim 20. The system of claim 17(Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract) wherein said means for determining, for each independent mode of the plurality of independent modes, a portion of a electromagnetic near -field contributed by each independent mode further comprises: means for coupling the impedance matrix for the reference pipe to another identical impedance matrix for the reference pipe to create an impedance matrix for a two-sided reference pipe having a common interface (D'Angelo: pg. 540, lines 14-24); means for solving the impedance matrix (D'Angelo: pg. 540, line 1-8) for the two-sided reference pipe by introducing the incident wave at the common interface of the two reference pipes (Barka: pg. 2566, lines 20-24); and means for determining the difference between the solution of the impedance matrix for the reference pipe, test fixture and aircraft engine component and the solution of the

impedance matrix for the two-sided reference pipe (D'Angelo: pg.536, equation 13 with pg. 536, lines 1-4 and figures 1 and 2 and pg. 540, lines 1-8).

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mr. Tom Stevens whose telephone number is (703) 305-0365, Monday-Friday (8:00 am- 4:30 pm) or contact Supervisor Mr. Kevin Teska at (703) 305-9704. The fax number for the group is 703-872-9306.

Any inquires of general nature or relating to the status of this application should be directed to the Group receptionist whose phone number is (703) 305-3900.

September 7, 2004

THS

KEVIN J. TESKA
SUPERVISORY
PATENT EXAMINER